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A NEW FOSSIL EOMEROPID (INSECTA, MECOPTERA) FROM THE YIXIAN FORMATION, LIAONING, CHINA

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Abstract A new species, *Typhothauma excelsa* sp. nov., of fossil eomeropid from the Late Jurassic to Early Cretaceous Yixian Formation (41.8°N, 120.7°E) of Liaoning Province in China is described. This new finding, highlighting diversity of eomeropids in the Late Mesozoic of Northeastern China, further enhances our knowledge of this enigmatic insect. The type specimen is deposited at the Key Laboratory of Insect Evolution & Environmental Change, Capital Normal University in Beijing, China.

***Typhothauma excelsa* sp. nov.**

Etymology. The specific name is derived from the Latin "*excelsus*" (meaning "excellent") referring to its complete venation.

Diagnosis. RP + MA with six terminal branches, MP with seven terminal branches and MP1 double, MP2 single.

Holotype. A specimen with one pair of complete fore wings and some legs antennae and hind wings preserved. No. CNU-MEC-NN2009004.

Locality and horizon. Chaomidian Village, Shangyuan Township, Beipiao City (41.8° N, 120.7°E), Liaoning Province, China; Yixian Formation, Late Jurassic to Early Cretaceous (Ren *et al.*, 1997).

Description. Antennae incomplete with many antennomeres, filiform (Figs 1, 4).

Forewing length 13.3 mm, width 5.5 mm; at the very base of the costal margin, a cluster of heavy setae (up to 0.5 mm long) for an area of about 2.5 mm wide; costal area narrow basally to humeral vein, distally broadened, traversed by three rows of cells and a strong and longitudinal secondary vein parallel to the costal margin with six and eight crossveins; four crossveins from ScP to the secondary longitudinal vein; 4 – 5 crossveins between the two longitudinal veins; ScP reaching the area of pterostigma; pterostigma present; RA, RP + MA and MP forming the "Eomeropidae triadic branching" (etb in Fig. 2); RA diverging anteriorly from RP + MA, as in *T. yixianensis* Ren & Shih, 2005 (Figs 2 – 3); RP + MA continuing straight with R; RA single, weakly zigzagged; RP + MA with two main branches, anterior one with three terminal branches, posterior one also with three terminal branches; MP bifurcated into two main branches, MP1 + 2 continuing the same direction, MP3 + 4 diverging posteriorly at a similar angle as *T. yixianensis*; MP1 with two branches, MP2 single, MP3 with two branches, MP4 with two branches, MP3 + 4 only touching CuA1 + 2 in wings; CuA1 + 2 least with two terminal branches; CuA3 + 4 strong and curvy zigzagged by crossveins, bent sharply posteriad approximately at branching of MP, with two terminal branches; CuP single, zigzagged by crossveins; three simple anal veins.

Head, thorax and abdomen not preserved.

Legs densely clothed with transverse rows of short setae. Tibiae somewhat longer and slender, with some spines.

Comparison. The new species can be distinguished from *T. yixianensis* Ren & Shih, 2005 by the following characteristics: 1) RP + MA with six terminal branches; 2) MP with seven terminal branches and MP1 with two branches.

Key words Mecoptera, eomeropidae, new species, fossil, Yixian Formation, Late Jurassic to Early Cretaceous.

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辽宁义县组原蝎蛉科（昆虫纲，长翅目）化石一新种

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摘　要　描述原蝎蛉科化石1新种，优秀云状原蝎蛉 *Typhothauma excelsa* sp. nov.。对新种与模式种做了比较。化石标本采自辽宁省北票市炒米甸村晚侏罗世/早白垩世义县组地层，模式标本保存于首都师范大学生命科学学院。

关键词　长翅目，原蝎蛉科，新种，化石，义县组，晚侏罗世 / 早白垩世.

中图分类号　Q915.819.7

原蝎蛉科 *Eomeropidae* Cockerell, 1909（= Notiothaumatidae Ebsen-Petersen, 1921）是长翅目中最小的一个科（Renato *et al*., 2009），世界已报道的原蝎蛉科现生种类和化石种类都很稀少。现生种类仅有1属1种 *Notiothauma reedi* M'Lachlan, 1877，被称为"活化石"，仅分布在智利南部的安第斯山脉的西面山坡假山毛榉森林里（Peña, 1968; Remington, 1968）。迄今为止全世界已报道的原蝎蛉科化石共5属8种（Cockerell, 1909; Ponomarenko *et al*., 1974; Willmann, 1978, 1987; Carpenter, 1992; Novkshonov, 1998; Ren *et al*., 2005; Archibald *et al*., 2005; Zhang *et al*., 2011），分布于俄罗斯、吉尔吉斯斯坦、美国、加拿大和中国，地质年代从三叠纪到晚始新世 / 早渐新世（表1）。

表1　世界已发现的原蝎蛉科昆虫化石名录

Table 1. A list of Eomeropidae fossils found in the world.

属 Genus	种 Species	分布 Distribution	地质年代 Geological age
Eomerope	*E. tortriciformis*, Cockerell, 1909	美国弗洛里森特 Florissant, USA	晚始新世 Late Eocene
Thaumatomerope	*T. neuropteroides*, Ponomarenko & Rasnitsyn, 1974	吉尔吉斯斯坦 Kirghizstan	三叠纪 Triassic
Eomerope	*E. asiatica*, Ponomarenko & Rasnitsyn, 1974	俄罗斯普尼莫耶 Primorye, Russia	晚古新世 Late Paleocene
Eomerope	*E. pacifica*, Ponomarenko & Rasnitsyn, 1974	俄罗斯 Russia	晚始新世/早渐新世 Late Eocene / Early Oligocene
Tsuchingothauma	*T. shihi*, Ren & Shih, 2005	中国内蒙古 Inner Mongolia, China	中侏罗世 Middle Jurassic
Typhothauma	*T. yixianensis*, Ren & Shih, 2005	中国辽宁 Liaoning Province, China	晚侏罗世 / 早白垩世 Late Jurassic / Early Cretaceous
Eomerope	*E. macabeensis*, Archibald, Rasnitsyn & Akhmetiev, 2005	加拿大不列颠哥伦比亚省 McAbee, Canada	早始新世 Early Eocene
Jurathauma	*J. simplex*, Zhang, Shih, Petrulevičius & Ren, 2011	中国内蒙古 Inner Mongolia, China	中侏罗世 Middle Jurassic

化石的鉴定和初步描绘主要借助于 Leica MZ1215 显微镜和绘图仪辅助完成，部分线条图借助于 Adobe Photoshop CS3 绘图软件完成。所有的化石标本保存于首都师范大学生命科学学院昆虫演化与环境变迁重点实验室。

长翅目 Mecoptera Packard, 1886

原蝎蛉科 Eomeropidae Cockerell, 1909

云状原蝎蛉属 *Typhothauma* Ren & Shih, 2005

模式种：*Typhothauma yixianensis* Ren & Shih, 2005

鉴别特征　前缘区有4条细的纵脉和多条横脉组成了5排翅室；Sc末端分支数是1~2；有翅痣；Sc、RA的末端在翅痣区域消失或模糊；RA脉1条，沿翅痣边缘向末端延伸；RP+MA和MP均双分支，末端分支数是9；CuA在近乎R与RP的分叉处分支，CuA脉末端分支数至少是2~3；CuA脉与MP3+4脉有短距离愈合，后又分开；CuP脉1条。

优秀云状原蝎蛉，新种 *Typhothauma excelsa* sp. nov.（图1~4）

正模　一块前翅保存较完好的标本，后翅、触角和足部分保存。编号：CNU-MEC-NN2009004。

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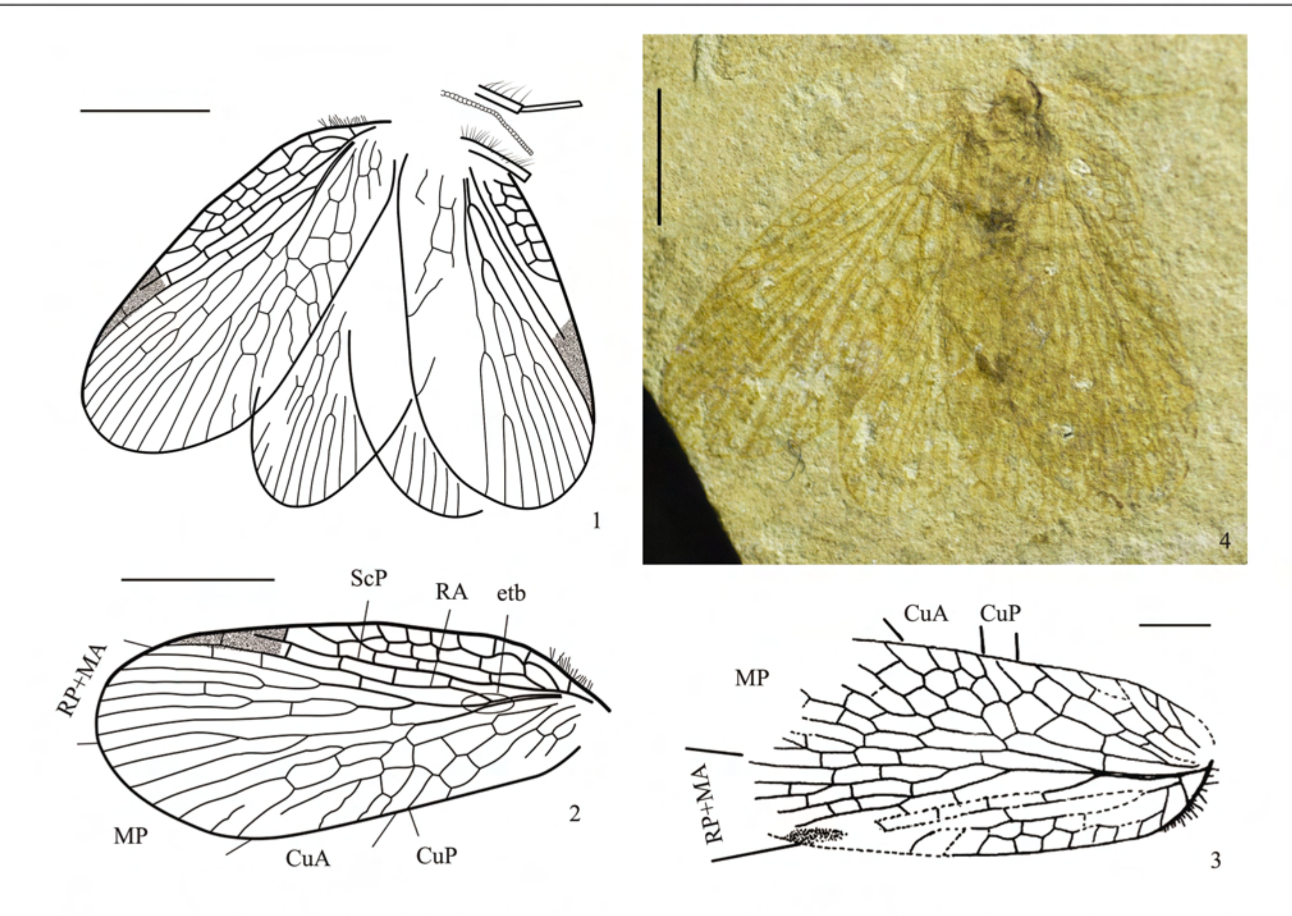


图1～4 优秀云状原蝎蛉，新种 *Typhothauma excelsa* sp. nov., holotype, CNU-MEC-NN2009004
1，4. 虫体（body） 2. 左前翅（left forewing） 3. 义县云状原蝎蛉右前翅（the right forewing of *Typhothauma yixianensis* Ren & Shih, 2005） 比例尺（scale bars）：1～2，4 = 4 mm；3 = 3 mm

产地及层位 辽宁北票，义县组（晚侏罗世/早白垩世）。

种征 RP + MA 的末端分支数是 6；RP + MA 的前支分支数是 3，后支分支数是 3；MP 分支数是 7；并且 MP1、MP2 均简单，MP1 分支数是 2，MP2 分支数是 1。

形态描述 一块前翅保存比较完整的标本，背面观；触角不完整包括很多节，线状。

前翅长 13.3 mm，宽 5.5 mm；在前缘脉基部着生一些刚毛，长约 0.5 mm；前缘脉边缘基部宽达 2.5 mm 的区域，分布有不少于 10 根的粗刚毛；前缘区基部突然变窄并且在肩横脉（Hu）后又变宽，前缘区 2 条纵脉形成了 3 排翅室，左前翅前纵脉与前缘脉之间有 8 条横脉，右前翅前纵脉与前缘脉之间有 6 条横脉；后纵脉与 ScP 脉之间有 4 条横脉；左前翅两条纵脉之间有 5 条横脉，右前翅两条纵脉之间有 4 条横脉；ScP 末端到达翅痣区域；有翅痣；RA、RP + MA 和 MP 脉形成原蝎蛉科 Eomeropidae 典型的三叉区（etb，图 2）；RA 从 RA + RP 的前方发出同 *Typhothauma yixianensis* Ren & Shih, 2005（图 2～3）；RP + MA 沿着 R 脉基干部继续延伸；RA 1 条，被横脉某种程度地弯曲，延伸到翅痣的后缘；RP + MA 有两主分支，前支分支数是 3，后支分支数 3；MP 有两主分支，MP1 + 2 沿着原方向延伸，MP3 + 4 在后面发出的角度如同 *T. yixianensis*，MP1 分支数是 2，MP2 分支数是 1，MP3 分支数是 2，MP4 分支数是 2，MP3 + 4 仅仅是点接触 CuA1 + 2；CuA1 + 2 分支数至少是 2；CuA3 + 4 分支数是 2，大约在 MP 的分叉处剧烈的向后弯曲；CuP 简单仅 1 条；3 条简单的臀脉 A。

头部、胸部、腹部未保存。

足密布横向行短刚毛；胫节细长，布有一定数量刺毛。

词源：新种种名源自拉丁词“*excelsus*”（优秀的），意指该种的翅脉保存较完整。

比较 新种与模式种义县云状原蝎蛉 *Typhothauma yixianensis* Ren & Shih, 2005 的区别在于：1）新种 RP + MA 的分支数是 6，而模式种 RP + MA 的分支数是 5；并且 RP + MA 分两支后，各分支数目不同，新种 RP + MA 的前支分支数是 3，后支分支数是 3，而 *T. yixianensis* 的 RP + MA 前支分支数是 2，后支分支数是 3；2）新种 MP 分支数是 7，而模式种

MP 分支数是 8；并且新种的 MP1 脉简单，分支数是 2，而模式种分支数是 3；新种的 MP2 分支数是 1，模式种分支数是 2；新种的 MP4 分支数是 2，而模式种分支数是 1。

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